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**TimeDerivative comments to the CONSULTATION on REGULATORY
FRAMEWORK FOR DEVICES USING ULTRA-WIDEBAND TECHNOLOGY**

TimeDerivative, Inc. is grateful for the opportunity to respond to the IDA public consultation. Founded in 2003, **TimeDerivative** is a consulting corporation registered in Florida, USA. Our associates offer a wide range of technical services focused on assisting with the developing, teaching and engineering of wireless networking technologies. We specialize in media-centric wireless PAN technologies, and especially in solutions based on Ultra-wideband (UWB) radio technologies. We are involved in product development strategies as well as in standards development. We and our clients are interested in developing and marketing devices incorporating UWB technology on a world-wide basis.

TimeDerivative understands that UWB technologies bring the potential for significant economic growth and wealth to a region, but also that there is a cost for the growth that is imposed on the incumbent spectrum users. However, we note that the incumbent spectrum users will also ultimately share in the growth and wealth generated by the commercial introduction of UWB technologies.

TimeDerivative believes that carefully designed UWB signals which obtain their fundamental UWB bandwidth from the short duration of UWB pulses, along with the careful coding of those signals, will result in signal signature that bears a close resemblance to white noise. Such signals present the most benign form of background noise, and thus the least probability of harmful interference to licensed spectrum users.

The Summary Position of TimeDerivative Inc. is:

- The following pro-active mitigation policy should be implemented:
 - (1) UWB devices powered from AC mains should be restricted to indoor use only
 - (2) hand-held and battery powered devices should be restricted to operation without any fixed infrastructure

- (3) operations aboard aircraft and ships should initially be prohibited until more experience is gained about the potential for interference to radionavigation
 - (4) UWB devices should be restricted to operating only with an associated receiver; beaconing to establish a link should be rigidly controlled and beacon duty cycles restricted.
- The allowed spectrum for UWB technologies should be continuous between 3400 and 10600 MHz, at a uniform e.i.r.p. of -41.3 dBm/MHz, with consideration given to extending the lower limit to 3100 MHz
 - The radio spectrum for UWB technologies should be made available on a fee-free and unlicensed basis
 - With the implementation of the listed pro-active mitigation policy there is no need for restricting the emissions between 4800 and 7000 MHz to anything less than -41.3 dBm/MHz
 - In view of the listed mitigation policies, the “out of band limits” need not be lower than -75 dBm/MHz at frequencies above 1 GHz
 - Devices operating below 960 MHz should be permitted at e.i.r.p. density of -49.3 dBm/MHz measured in a 120 kHz bandwidth, and with restrictions on duty cycle.

Specific answers of TimeDerivative to the Consultation questions are below.

Question 1 - *IDA invites views and comments on the proposal to allow UWB devices to operate in frequency bands which are used for other radiocommunication services such as fixed-satellite (FSS), fixed services (FS) and radionavigation.*

TimeDerivative associates are involved with continuous-pulse based UWB (C-UWB) technology which is particularly suited for high data rate short range communications, and is primarily used in the indoor environment. C-UWB signals derive their UWB bandwidth directly from the short duration of the UWB pulses which are waveform-coded and sent as a continuous stream. It is the simplest, most robust and most efficient way of achieving high data rates using the smallest e.i.r.p. densities, and produces the most benign spectral signature. The UWB transmitter operates only in conjunction with an associated UWB receiver and becomes silent when a communications link is not established. This follows regulatory policy established in another jurisdiction (USA). Upon implementation of the mitigation policies listed in the summary position, there is a very low probability of interference with the operation of the fixed- satellite services (FSS), or the fixed services (FS) or radionavigation. TimeDerivative supports a restriction on the use of UWB devices on board aircraft and ships. We believe that indoor use provides sufficient pro-active mitigation for an already low likelihood of potential interference with these services.

Question 2 - *IDA also seeks views on the possible scenarios of harmful interference from UWB devices to other licensed bands and the possible measures to reduce the risk of interference.*

TimeDerivative are interested primarily in the hand-held and peer to peer use of UWB technologies. Such use, along with the inherently low impact C-UWB signaling format, the signal presents a low likelihood of potential interference with business or other data communications in the bands contemplated for UWB technologies. Because of the low e.i.r.p. densities and generally short ranges due to this restricted emission level, aggregated interference is not likely. Naturally, UWB devices may not cause any interference, but as unlicensed devices they should accept interference, if any, especially from other licensed devices.

Question 3 - *IDA welcomes views and comments on the proposal to adopt a licence-exempt approach for UWB consumer and business data communication systems which comply with the UWB technical specification and operate with peak emission within the 3400 MHz and 10600 MHz band.*

The UWB technology favored by TimeDerivative is designed to operate at a field strength of less than 500 μ V/m per MHz of bandwidth as measured at a 3 m distance. This is equivalent to an e.i.r.p. of -41.3 dBm/MHz, and is commensurate with the unintentional emissions of electrical devices and electronic devices such as computers, television receivers and so on. We applaud the general access to the spectrum from 3400 to 10600 MHz, we feel that sufficient and effective mitigation of potential harmful interference can be provided by restricting operation as follows:

- UWB devices powered from AC mains should be restricted to indoor use only
- hand-held and battery powered devices should be restricted to operation without any fixed infrastructure
- operations aboard aircraft and ships should initially be prohibited until more experience is gained about the potential for interference to radionavigation
- UWB devices should be restricted to operating only with an associated receiver; beaconing to establish a link should be rigidly controlled and beacon duty cycles restricted.

Question 4 - *IDA further invites comments on the proposal to allow licence-exempt UWB devices implemented with mitigation techniques to operate at a higher peak emission level within the 3400 to 4800 MHz band as compared to generic UWB devices without mitigation techniques.*

There is a “mitigation” technology variously referred to as “detect and avoid” (DAA), however it takes on the character of “proving a negative”. While UWB devices might be constructed that can sense the presence of specific *transmitters* within a spectrum segment they can not sense the presence of a

receiver. Since the interference potential is to a *victim receiver*, then any mitigation technique based on spectrum sensing such as DAA is doomed to failure. Instead, all UWB devices should be allowed one emitted power spectral density of -41.3 dBm/MHz, across the entire proposed UWB band, and the “mitigation” should be relegated to the pro-active rules and policies restricting the deployment scenarios. TimeDerivative favors the mitigation policy expressed in the Summary above and in the response to Question 3.

Question 5 - *IDA welcomes views and comments on the proposal to adopt licence-exemption approach for UWB vehicular radar devices which comply with the UWB technical specification and operate with peak emission within frequency bands 21650 – 29500 MHz and 77000 – 81000 MHz.*

TimeDerivative is not currently interested in vehicular radar devices.

Question 6 - *IDA welcomes views and comments on the decision to license, on a case-by-case basis, the use of UWB imaging systems with peak emission below the 960 MHz or in the 3400 to 10600 MHz band.*

TimeDerivative is not currently interested in imaging devices. However, regarding operation below 960 MHz, the IEEE802 Standards Organization has produced a Standard: P802.15.4a which extends the P802.15.4 by providing for several new physical layers (PHY), including UWB PHY operating in channels between 3100 and 10600 MHz, as well as a channel below 960 MHz. We and our clients believe that there is a specific need for location and RFID types of devices based on pulsed UWB operating below 960 MHz. Pro-active mitigation rules stated earlier are sufficient to render such devices free of potential for harmful interference. The frequencies below 960 MHz offer significant propagation advantages for certain devices. We therefore recommend that IDA consider allowing emission levels $200\mu\text{V/m}$ as measured in a 120 kHz bandwidth at a 3 m distance. This is equivalent to an e.i.r.p. density of -49.3 dBm measured with a CISPR quasi peak detector having a 120 kHz resolution bandwidth. Below 960 MHz only pulse based UWB technologies should be permitted. Duty cycle restriction should also be considered.

Question 7 - *IDA also seeks comments if licensing conditions are required as further safeguards to existing users in the abovementioned band. If so, please identify and explain the potential interference to the mobile and trunked services from the UWB imaging devices operating in the frequency band below 960 MHz. Please also explain what are the safeguard measures that could be adopted.*

Regarding potential operation below 960 MHz, UWB technologies would operate at e.i.r.p. density levels that are at or below levels emitted by unintentional emissions and residual radiation from electrical and electronic devices. Unless fees are contemplated for unintentional emissions by electrical and electronic devices, fees should be waived for any device operating at or below the -49.3

dBm/120kHz level. Fees would render UWB technologies uneconomical and would hopelessly stifle innovation.

Question 8

IDA welcomes views and comments on the proposed licensing fee structure for UWB devices. Please provide supporting reasons to justify your view.

UWB technologies operate at e.i.r.p. density levels that are at or below levels emitted by unintentional emissions and residual radiation from electrical and electronic devices. Unless fees are contemplated for unintentional emissions by electrical and electronic devices, fees should be waived for any device operating at or below the -41.3 dBm/MHz level. Fees would render UWB technologies uneconomical and would hopelessly stifle innovation.

Other Comments

We take note of the very low “out of band” limits that are shown in the “Proposed UWB Emission Limits’ of Annex A. In particular, emitted field strengths below $10.26\mu\text{m}$ measured at 3 m are at the limit of measurement technology. This corresponds to measuring an e.i.r.p. equivalent to -75 dBm/MHz. We note the IDA proposes levels as low as -85 dBm for frequencies above 1 GHz. This level is exceeded by the natural black body radiation from a single human being in a room temperature environment (approximately to $20\log(f_{\text{GHz}})-106.7$ dBm/MHz) at and above 12.2 GHz. We urge that the IDA reconsider these low limits, especially in when viewed with the pro-active mitigation policies listed in the summary.

In Conclusion TimeDerivative would again like to express our thanks for the opportunity to respond to the IDA Consultation. We believe that regulations should balanced the prospect of significant economic benefit with the potential short term cost imposed by potential interference by UWB technologies to licensed spectrum users.

With very best regards,

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